

Cruise control with interval sensing for a motor vehicle

Publication number: EP1304251 (A1)

Publication date: 2003-04-23

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Classification:

- **International:** B60K31/00; B60T7/22; B60K31/00; B60T7/22; (IPC1-7); B60K31/00; B60T7/22

- **European:** B60K31/00D

Application number: EP20020021956 20020930

Priority number(s): DE20011051717 20011019

Also published as:

 EP1304251 (B1)

 DE10151717 (A1)

Cited documents:

 EP1195283 (A1)

 EP0992387 (A2)

 DE19924142 (A1)

 DE19958520 (A1)

 DE4100963 (A1)

Abstract of EP 1304251 (A1)

The system has a distance sensing arrangement and automatically ensures a minimum vehicle separation at high speeds and in stop and go traffic situations. It presents a uniform system structure to the driver and is not noticeably divided into different speed ranges, although it responds differently in stop and go situations than in high speed situations

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[0001] The invention relates to a speed monitoring system with spacer sensor technology for a motor vehicle, whereby this system not only with higher running speeds, but in particular also in the Stop&Go operation the automatic adherence to a minimum distance to a preceding vehicle, which is recognized of the system than a target object, ensured. To the known state of the art to the DE 199 58 520 A1 one refers.

[0002] Motor vehicles, in particular car, with a speed monitoring system with spacer sensor technology can become today already with some manufacturers purchased. A such bspw. with the applicant of the present patent application the bottom designation "Active Cruise control" offered system possible it to move the motor vehicle bottom adherence to a desired distance to before this driving Kfz (this becomes designated as target object) with a desired or a corresponding smaller speed an automatic. From the principle extended thereby the general known speed regulation, which keeps a certain predetermined speed, is around an additional spacer function, so that the use of such "active" Fahrgeschwindigkeitsreglung becomes also possible in the dense motorway and highway traffic. These so-called, "active speed regulation" holds the predetermined desire speed like the conventional speed governors, if the own lane is free. A spacer sensor technology mounted at the motor vehicle, which can work in particular on radar basis, recognizes a preceding target object and/or. (Force) vehicle in the own lane, then becomes the own speed to that of the preceding Kfz/target object adapted, in such a manner that one in the "active Fahrgeschwindigkeitsreglung" and/or. In the corresponding speed control system contained longitudinal control an automatic situation-suitable distance to the preceding Kfz/target object keeps and accordingly the "own" running speed, i.e. that with the so-called. active speed regulation of equipped vehicle, reduced.

[0003] Bspw. the system offered with the applicant of the present patent application the bottom designation "Active Cruise control" is only in a speed range of 30 - 180 km/h more useful, during in the speed range below 30 km/h this system is not more activatable and/or. after a certain algorithm automatic switches itself off. Also standing target objects - those distance held to in principle likewise become must - can become not or only conditional for the control used.

[0004] Around a speed monitoring system with spacer sensor technology also in the speed range below bspw. to use to be able, this presupposes 30 km/h in particular in pilot situations a sensor range of vision extended by additional sensors. Further an algorithm between relevant standing and driving target objects should to differentiate be able. A possible system development could of it consist will differentiate between a conventional range of control, with respect to which no response on standing targets made, and a Stop&Go range, with respect to which on standing target objects responsive. This so-called. Stop&Go range can do speed-moderate upward by a limit value bspw. in the order of magnitude of 30 km/h limited its.

[0005] In the DE initially specified 199 58 520 A1 a speed monitoring system with spacer sensor technology is 1 described after the preamble of Claim, such a discrimination between the conventional operation with higher driving speeds and a particular Stop&Go operation for relative small running speeds as well as the Fzg standstill makes and dependent responsive responsive of the respective operating condition on standing target objects either not or. This discrimination between a so far conventional range of control with higher running speeds and a so-called. Stop&Go range (and thus between a response and/or. response on standing target objects) however the driver of the Kfz's in suitable way reported does not have to become. Perhaps the driver must switch even by a control action between the two ranges of control mentioned.

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[0006] Such a designed extension of a conventional (and only with higher running speeds working) speed monitoring system into the lower speed range (so-called. Stop&Go operation) in particular with a change-over which can be accomplished by the driver leads however rapid to variety of necessary control actions, confusing the driver. By this variety a driver possibly also danger, runs the ranges, in those on standing target objects responsive and/or. not responsive will to confound. In addition with consideration of standing target objects the danger exists that bspw. due to the selection of a not relevant target object (e.g. a vehicle parking at the roadside, barriers, etc.) one both for the driver of the Kfz and for the subsequent traffic not plausible vehicle reaction e.g. in form of an unexpected strong deceleration of the vehicle travel, caused will can.

[0007] A remedy for this described problem to point out, is object of the instant invention.

The solution of this object is with a speed control system after the preamble of Claim 1 characterised in that for the driver of the motor vehicle an unitary system structure presents itself, which is in particular not obvious into various speed ranges divided, although the speed monitoring system in the Stop&Go operation at least on one 6 conditions indicated in the claims 2 or of the 4 or differently responsive than with higher running speeds, as in one of the claims 2 or 4 or 6 indicated. Favourable developments are content of the respective Unteransprüche.

[0008] General one becomes the recovery of the disadvantages specified above thus a speed monitoring system with spacer sensor technology proposed, which works practical in the entire operating range of the Kfz and in particular also in the Stop&Go operation and which thereby no discrimination between various ranges, obvious for the driver, makes. The driver must serve thus only a single system with essentially unitary and in particular meaningful, clear understandable behavior patterns. On the other hand discriminated is to become systems-inherent, i.e. between various ranges. to the increase of the system security and/or. to the avoidance of bad reactions of the driver quite different system reactions are desired on certain conditions, depending on whether the Fzg. current with higher speed is driven or in the Stop&Go operation is. First mentioned that the system in the Stop&Go operation should not ignore a standing target object perfect, is however not as with a first moved and slowing down target object to then react itself may in this place as example, since this would lead to mismatching strong deceleration procedures. Becomes latter on that (i.V.m. the explanations to claim 6) still more near received.

[0009] A speed monitoring system according to invention with spacer sensor technology contains thus none from the driver to or change-over between that, which can be acknowledged which can be transacted, of so-called, Stop&Go range and a range of higher running speeds, but it concern quasi a continuous system, from the Fzg standstill to if necessary. reduced maximum speed of the Fzg's is enough and no obvious range selection contains. With the fact proposed becomes that the desire speed as in the known state of the art in a range between bspw. approx. 30 km/h and (if necessary. reduced) maximum speed of the Fzg's predetermined will can.

[0010] While in the known state of the art an operation of the service brake is always by the driver (thus usually depressing the brake pedal) an absolute switching off criterion for the speed monitoring system, is to be deviated now from this prior principle, if the motor vehicle stands, but otherwise operative is.

[0011] So a system disconnection should be with Fzg standstill from safety reasons only by a complex control action or action of the driver possible (claim 2). A simple control action could become also inadvertently triggered and so a rear end collision o.a. provoke, in particular if the own Kfz becomes held by the speed monitoring system (with spacer sensor technology) in the Stop&Go operation a rear standing vehicle. Then the danger exists that the driver inadvertently the brake pedal or a hand control element of the system (e.g. an off switch) touched, whereupon the system would switch off and according to which at least with a roadway slope the Kfz automatic in movement could set itself. In this sense an inadvertent operation of the accelerator (a general load desire giver) would be still more critical, if from this a system shutdown would result. Therefore a system shutdown only whole one is to be able to take place consciously.

[0012] A possible condition for a shutdown of the system by the driver in the conditions and thus a complex action in the sense of the claim 2 is bspw. the operation of the service brake in combination with a simultaneous operation of an on-off switch for the speed monitoring system, whereby it can concern preferred a hand control element (key or such). In addition, a system shutdown from the conditions can become made if the accelerator (and/or. general a load desire giver operating from the driver to) operated becomes until a certain minimum speed (e.g. 10 km/h) achieved becomes and/or if the accelerator or such. at least over a certain time interval (bspw. for some seconds) operated become and/or. becomes. So a shutdown of the speed monitoring system can become by accidental affecting of the accelerator safe avoided.

[0013] From the conventional absolute switching off criterion for the speed monitoring system in form of a Fahrer-Betätigung of the service brake also one deviates, if - becomes as 4 proposed in the claim - from the Fzg standstill with service brake operated of the driver the speed monitoring system of the driver is more activatable. This activation can be made preferred (again) by a hand control element. After made system activation the system holds the service brake tensioned, so that the driver the brake pedal or such. not other depressed to hold must, until the driver gives a driving regulated by the system by a driving off command.

[0014] In other words expressed can and/or. a speed active system according to invention with spacer sensor technology is contrary to the conventional systems thus also in the conditions, i.e. with stationary, however operative Kfz activatable its. A substantial criterion for ready state is bspw. that the Fzg drive unit switched on, i.e. active is. As Ingang setting the speed monitoring system (with spacer sensor technology) the driver is to then regard the motor vehicle in the conditions first by operation of the Fzg service brake. After activation of the system by the driver (bspw. by appropriate operation of an on-off switch) becomes by corresponding drive of a brake actuator or a such. the Kfz without effort of the driver other in the conditions held in each case, i.e. independent of it whether the speed monitoring system has a target object recognized and/or. recognizes or not, i.e. also, if at all no target object is present.

[0015] In the latter case the driver of the Kfz can over an appropriate indication and if necessary. get reported with an additional acoustic signal that it can request the speed monitoring system over a certain control action for automatic driving off (so-called. "Go Request"). However if a target object is present or (bspw.) if recognized becomes that itself a first standing object (slow) can do remote, so that this target object becomes detected and recognized then with moving this target object away likewise a so-called. "Go Request" triggered become, i.e. the driver becomes the delivery of a driving off command prompted (claim 5). After implementing a corresponding control action by the driver, i.e. after delivery of the driving off command (bspw. in form of acknowledging the "Go Request" - signal) then the speed

monitoring system can loosen the service brake and accelerate the Kfz on the desired speed and/or. the speed-controlled registered target object to follow leave. That can do so-called. It exists driving off command of the driver in the fact that a so-called. Resumption key (and/or. general a hand control element) or also the load desired giver, i.e. the accelerator or such. operated becomes.

[0016] Around between unintentional operation of the resumption key mentioned or the accelerator and the delivery of a so-called described in the preceding shoulder. Driving off commands to differentiate, one can couple the corresponding (n) action (EN), which can be accomplished by the driver, still additional with one minimum implementing duration, i.e. the driver must bspw. the resumption key at least for a predetermined time of some seconds press, so that the vehicle drives off then actual automatic. Same one applies to the operation of the accelerator or such. In all other respects the speed monitoring system the analogue systems at present located in series can works, i.e. during (such) a system activation in the speed range between Fzg standstill and a critical speed, above those. during a system activation in the so-called. Stop&Go operation, the automatic desired speed on the critical speed mentioned (bspw. 30 km/h) or also on inner place the legally permissible maximum speed set become.

[0017] In the claim 6 is an other logic indicated, with which the safety of a speed monitoring system with speed sensor technology in the Stop&Go operation can become increased opposite the known state of the art. Therefore becomes within a speed range between the Fzg standstill and that if necessary. slight reduced limit value for higher running speeds, above whose in principle target objects standing on A priori responsive does not become, with the recognizing of a standing target object an automatic deceleration with essentially constant deceleration initiated, which is in the prospective lane. Simultaneous ones one refers with exception of this deceleration mentioned the speed control system disabled and the driver of the Fzg's impressive to this particular situation.

[0018] As initially already mentioned became, the danger exists with a consideration of standing target objects that bspw. due to an incorrect detection or due to the selection of a not relevant target object (e.g. a vehicle parking at the roadside, barriers, etc.) one both for the driver of the Kfz's and for the subsequent traffic not plausible vehicle reaction e.g. in form of an unexpected strong deceleration of the vehicle travel, caused becomes. Therefore standing target objects of the system should become differently treated than driving target objects, whereby it might on the other hand not be recommendable to negate in the Stop&Go operation the presence of standing objects complete i.e. not to consider standing objects at all.

[0019] Here now proposed in the range higher running speeds as before conventional no standing target objects will accept and in the so-called. Stop&Go operation, i.e. with running speeds, to mind slight below bspw. 30 km/h lie to produce a certain system reaction if the probability is high that itself determined, from the outset (i.e. a priori) standing object in the own lane of the Kfz's with the speed monitoring system finds. This response is to consist according to invention of the fact that the Kfz for safety's sake with a relative small (and essentially constant) deceleration decelerated will and that (essentially simultaneous) the speed monitoring system becomes disabled. Thereby the initiated deceleration becomes of course and/or. the started deceleration procedure other continued. With the fact it is substantial that the driver of the Kfz to this situation one refers, i.e. that the driver over a signal or a such. reported becomes that the system does not only have (in paths) standing an object recognized, but that itself the system has automatic disabled, so that the other handling becomes only more alone predetermined of the driver.

[0020] How in the claim 7 indicated is, thereby only a target object standing in the prospective lane, which the motor vehicle up to a certain border distance approached, can in which described manner considered just become, whereby the magnitude of this border distance can be variable and dependent of the current running speed.

[0021] Only for the sake of completeness is mentioned that a meaningful, there relative uncritical value for the essentially constant deceleration in the order of magnitude of $1,5 \text{ m/s}^2$, specified in the claim < 6 > lies. Furthermore it is pointed out that it can be meaningful for system-controlled braking operations without a system disconnection connected thereby, if in the Stop&Go operation higher acceleration and delay borders allowed to become than in (so far already in series of located) driving with higher running speeds (in which no standing target objects become fundamental considered), there in the Stop&Go operation and thus in a relative low speed range if necessary. very rapid on a preceding vehicle and/or. Target object responsive will must. A over goos range defined can quite become, in that the respective delay limit values etc. dependent adapted continuous of the current driving speed becomes.

[0022] With exception of the described "special response" on a standing object determined in the own lane (deceleration with essentially constant deceleration and system disconnection) thus only driving or driving off or continuous objects become accepted as relevant target objects. If a driving target object brakes however, while according to invention the Kfz equipped with the speed monitoring system follows this, into the conditions, then this object becomes accepted as target object likewise. The indicated control actions and operating conditions simple and for the driver transparent become fundamental. Simultaneous one becomes the danger of false detections and of system reactions minimized not adapted to the traffic conditions, whereby it is still pointed out that quite a variety of details different of or complementary designed to the above explanations can be, without the content of the claims to leave.

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[0020] How in the claim 7 indicated is, whereby only a target object standing in the prospective lane, which the motor vehicle up to a certain border distance approached, can in which described manner considered just become, whereby the magnitude of this border distance can be variable and dependent of the current running speed.

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1. Speed monitoring system with spacer sensor technology for a motor vehicle, whereby this system presents itself to ensured, characterised in that not only with higher running speeds, but in particular also in the Stop&Go operation the automatic adherence to a minimum distance to a preceding vehicle, which is recognized of the system than a target object, for the driver of the motor vehicle an unitary system structure, which is in particular not obvious into various speed ranges divided, although the speed monitoring system in the Stop&Go operation at least on one 6 conditions indicated in the claims 2 or of the 4 or differently responsive than with higher running speeds, as in one of the claims 2 or 4 or 6 indicated.
2. Speed monitoring system with spacer sensor technology according to claim 1, characterised in that after reaching the Fzg stop by an automatic deceleration procedure the system only by a complex action of the driver is disconnectable and differently than with higher running speeds in particular not by a simple operation of the service brake or a hand control element of the system or by a short operation of the load desire giver (accelerator or such) disabled becomes.
3. Speed monitoring system with spacer sensor technology according to claim 2, characterised in that the complex action of the driver beside the operation of the service brake an additional driver action requires and/or that an operation of the load desire giver becomes only then interpreted as complex action, if this operation over a longer time interval or up to reaching a certain minimum speed made.
4. Speed monitoring system with spacer sensor technology according to claim 1, characterised in that from the Fzg standstill with service brake the speed monitoring system of the driver, operated of the driver, is more activatable, according to which the system holds the service brake tensioned, until the driver gives a driving regulated by the system by a driving off command, while at least becomes always disabled with higher running speeds with an operation of the service brake the system.
5. Speed monitoring system with spacer sensor technology according to claim 4, characterised in that of the drivers to the delivery of the driving off command prompted becomes, if itself before the motor vehicle which is and as such recognized target object a remote.
6. Speed control system with spacer sensor technology according to claim 1, characterised in that within a speed range between the Fzg standstill and that if necessary, slight reduced limit value for higher running speeds, above whose in principle target objects standing on A priori responsive does not become, with recognizing itself in prospective lane finding standing target object automatic deceleration with essentially constant deceleration initiated becomes, and that the simultaneous driver of the Fzg's to this situation, becomes disabled in which with exception of the deceleration mentioned the speed control system it is referred.
7. Speed control system with spacer sensor technology according to claim 6, characterised in that only a target object standing in the prospective lane, which the motor vehicle up to a certain border distance approached, in which in claim 6 described manner considered becomes.
- ▲ top 8. Speed control system with spacer sensor technology according to claim 7, characterised in that the magnitude of the border distance variable and of the current running speed dependent is.
9. Speed control system with spacer sensor technology after one of the claims 6 - 8, characterised in that the essentially constant deceleration in the order of magnitude of 1,5 m/s² lies.
10. Speed control system with spacer sensor technology after one of the preceding claims, characterised in that in principle only driving or continuous objects as target objects accepted become.